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310 CMR 7.40:
THE MASSACHUSETTS
LOW EMISSION VEHICLE PROGRAM

BACKGROUND DOCUMENT AND TECHNICAL SUPPORT FOR PUBLIC HEARINGS ON THE PROPOSED AMENDMENTS TO THE STATE IMPLEMENTATION PLAN FOR OZONE; AND PUBLIC HEARING AND FINDINGS UNDER THE MASSACHUSETTS LOW EMISSION VEHICLE STATUTE

Regulatory Authority: Massachusetts General Laws, Chapter 111, Sections 142A through 142M

January 2004

TABLE OF CONTENTS

APPENDICES

* These documents are available for public review at the Department of Environmental Protection, One Winter Street, 2nd Floor, Boston, Massachusetts. They are also available on the CARB Zero Emission Vehicle Program web page at:

www.arb.ca.gov/msprog/zevprog/2003rule/2003rule.htm.

LIST OF TABLES

LIST OF ACRONYMS

ACP	Alternative Compliance Plan (Massachusetts) & Alternative Compliance Path (California)
AT PZEV	advanced technology partial zero emission vehicle
ATV	advanced technology vehicle
CAA	Clean Air Act
CARB	California Air Resources Board
CCR	California Code of Regulations
CMR	Code of Massachusetts Regulations
CO	carbon monoxide
DEP	Massachusetts Department of Environmental Protection
EPA	U.S. Environmental Protection Agency
EV	electric vehicle
g/mi	grams per mile
GVWR	gross vehicle weight rating
HDDE	heavy-duty diesel engines
HEV	hybrid electric vehicle
IVM	intermediate volume manufacturer
LDT	light-duty truck
LDT1	light-duty truck with a loaded vehicle weight of 0-3,750 pounds
LDT2	a LEV II light-duty truck with loaded vehicle weight of 3,751 to a gross vehicle weight of 8,500 pounds, or a LEV I light-duty truck with a loaded vehicle weight of 3,751 to 5,750 pounds
LEV	low emission vehicle
LVM	large volume manufacturer
MEPA	Massachusetts Environmental Policy Act
MGL	Massachusetts General Laws
MY	model year
NAAQS	National Ambient Air Quality Standards
NESCAUM	Northeast States for Coordinated Air Use Management
NEV	neighborhood electric vehicle
NLEV	National Low Emission Vehicle Program
NMHC	non-methane hydrocarbons
NMOG	non-methane organic gases
NO_2	nitrogen dioxide
NOx	nitrogen oxides
NTE	not to exceed
PC	passenger car
PM	particulate matter
ppm	parts per million
ppsd	pounds per summer day
PZEV	partial zero emission vehicle
SIP	State Implementation Plan
SULEV	super ultra-low emission vehicle
SUV	sport utility vehicle
Tier 1	Tier 1 Motor Vehicle Control Program
TLEV	transitional low emission vehicle
tpsd	tons per summer day
VOCs	volatile organic compounds
ZEV	zero emission vehicle

Background Document and Technical Support for:

Public Hearings on the Amendments to the State Implementation Plan for Ozone; and Hearing and Findings under the Massachusetts Low Emission Vehicle Statute

310 CMR 7.40: The Massachusetts Low Emission Vehicle Program

January 2004

The Massachusetts Department of Environmental Protection (the "Department") filed amendments to 310 CMR 7.40, the Low Emission Vehicle (LEV) Program regulation, with the Massachusetts Secretary of State as an emergency regulation on December 19, 2003. These amendments were effective upon filing and were published in the Massachusetts Register on January 2, 2004. In order to make the regulations permanent, the Department is now soliciting public comment on the regulation to comply with the public review process requirements of Massachusetts General Laws (M.G.L.) Chapter 30A. The Department will hold a public hearing on the amendments on February 25, 2004 and the deadline to submit public comments is February 25, 2004.

I. INTRODUCTION

The federal Clean Air Act (CAA) allows states to adopt California motor vehicle emission standards which are more stringent than the federal motor vehicle emission standards if the standards are identical to California standards and are adopted at least two years before the start of the model year to which the standards apply. Under M.G.L. c.111, Sections 142B and 142K, the Department is required to adopt California emission standards unless the standards will not achieve greater emission reductions, in the aggregate, than federal emission standards.

In 1991, the Department promulgated the first set of LEV regulations, which adopted the California motor vehicle emissions standards, including the mandate for zero emission vehicles (ZEVs). In January of 2003, the California Air Resources Board (CARB) proposed revisions to the ZEV mandate. These revisions were finalized by CARB on December 19, 2003. The Department adopted these revisions as an emergency regulation on December 19, 2003.

The California revisions include amendments to section 1962, Title 13 of the California Code of Regulations (CCR), and to the "California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (the ZEV Standards and Test Procedures) which is incorporated by reference in section 1962, Title 13 of the CCR. The Department is proposing to adopt the California revisions in 310 CMR 7.40. The amendments to 310 CMR 7.40, as discussed in this Background Document, pertain exclusively to the ZEV mandate and do not change other provisions of the Department's LEV regulations.

In adopting the 2003 revisions to the California ZEV regulations, the ZEV mandate will apply in Massachusetts beginning with model year[1] (MY) 2007. The auto manufacturers may either meet their

[1] Model year, as defined in 40 CFR §85.2304, means the "annual production period" beginning either: when any vehicle or engine within the engine family is first produced; or on January 2 of the calendar year preceding the year

ZEV obligation through a combination of ZEVs, partial ZEVs (PZEVs)[2], and advanced technology partial ZEVs (AT PZEVs) [3], or they may produce a combination of fuel cell vehicles and other ZEVs as part of the California Alternative Compliance Path (ACP). The California ACP allows manufacturers to apply AT PZEVS to the pure ZEV category and PZEVs to the AT PZEV category, thereby encouraging manufacturers to advance fuel cell technology while producing significant numbers of AT PZEVs and PZEVs. Other significant changes to the regulation include amendments to the hybrid electric vehicle (HEV) criteria, elimination of the fuel efficiency and economy standards for AT PZEVs and revisions and additions to the existing vehicle credit structure. The details of these compliance choices are discussed in Section IV of this document.

Under the Massachusetts ZEV regulation, manufacturers may also opt into the voluntary Northeast Alternative Compliance Plan (ACP). An agreement between Massachusetts, New York and Vermont and promulgated at 310 CMR 7.40(14), the Northeast ACP offers automobile manufacturers added flexibility to comply with the ZEV mandate. *The Department is not proposing any changes to the Northeast ACP in 310 CMR 7.40 but is seeking comment from interested parties on whether to continue this plan or to modify it in light of the most recent revisions to the ZEV mandate by CARB.*

The implementation of the most recent revision to the California ZEV mandate will result in improved air quality and greater reductions in emissions of non-methane hydrocarbons (NMHCs) [4], nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO) and air toxics.

II. BACKGROUND

This section discusses the CAA, the Massachusetts law that pertains to the existing LEV regulation and a history of the current Massachusetts LEV Program and the existing ZEV mandate.

The Federal Clean Air Act Provisions

Although section 209(a) of the CAA prohibits states from adopting or enforcing standards for new motor vehicles or new motor vehicle engines, section 209(b) allows the State of California to adopt its own motor vehicle emissions standards if the U.S. Environmental Protection Agency (EPA) grants a waiver for the standards. According to section 209(b), EPA must approve a waiver proposal if it finds that the California standard "…will be, in the aggregate, at least as protective of public health and welfare as applicable Federal standards."

Section 177 of the CAA authorizes states to adopt and enforce California's motor vehicle emission standards, which are more stringent than federal emission standards. Section 177 also mandates

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for which the model year is designated, whichever date is later. The annual production period ends either: when the last such vehicle or engine is produced; or on December 31 of the calendar year for which the model year is named, whichever date is sooner.

[2] PZEVs are vehicles that meet super ultra low emission vehicle (SULEV) standards, have zero evaporative emissions and an extended vehicle warranty for emission control equipment of 150,000 miles or 15 years, whichever occurs first.

[3] AT PZEVs are vehicles that have limited emissions but advanced ZEV components such as an advanced battery integral to the operation of the vehicle power train or an electric power train.

[4] The term non-methane hydrocarbons (NMHC) refers to any hydrocarbon species other than methane and, for the purpose of characterizing the ozone-forming potential of organic emissions from automobiles, is used interchangeably with volatile organic compounds (VOCs) and non-methane organic gases (NMOGs).

that states electing this option must adopt standards that are identical to California's at least two years before the commencement of the model year to which the standards will apply.

Massachusetts Law

In 1990, the Massachusetts Legislature enacted Chapter 410 of the Acts of 1990, which is codified at M.G.L. c. 111, Section 142K. This law mandates that the Department adopt and implement California motor vehicle emission standards

> "unless, after a public hearing, the Department establishes, based on substantial evidence, that said emission standards and a compliance program similar to the state of California's will not achieve, in the aggregate, greater motor vehicle pollution reductions than the federal standards and compliance program for any such model year."

Chapter 410 of the Acts of 1990 and M.G.L. c. 111**,** Section 142K are included as Appendices A. and B.

History of the Massachusetts LEV Program

Since CARB promulgated the LEV regulation in 1990, the California ZEV program requirements have been amended four times. Subsequent to each revision, the Department amended the Massachusetts LEV Program regulations to reflect the California amendments. This section discusses the Massachusetts LEV program in two parts: the amendments from 1991 to 2001, and the 2002 amendments, which represent the Department's adoption of the 2001 California ZEV amendments and are the most recent revision to the Massachusetts ZEV program.

The 1991- 2001 Amendments

In 1991, the Department promulgated 310 CMR 7.40, the LEV Program regulation. This regulation adopted the California LEV program and the LEV I emissions standards for all passenger vehicles and LDTs up to 6,000 pounds gross vehicle weight rating (GVWR) delivered for sale in Massachusetts, effective with MY 1995 vehicles. DEP demonstrated that the California LEV I standards are more protective than the federal Tier I Motor Vehicle Control Program (Tier I) and the voluntary National Low Emission Vehicle (NLEV) Program. The Department also adopted California's ZEV requirements, calling for 2% ZEVs in MY 1998 passenger vehicles, 5% in MY 2001 vehicles and 10% in MY 2003 and later vehicles.

The Department then submitted the LEV regulation to the EPA as part of the Massachusetts State Implementation Plan (SIP), which delineates the Department's strategies and programs to attain and maintain the air quality milestones of the CAA, and to attain and maintain the National Ambient Air Quality Standards (NAAQS) for ozone. (The NAAQS are the public health standards for several criteria pollutants, including ozone). This SIP submittal showed that the Department achieved greater emission reductions with the implementation of the California LEV program than if federal standards were in place for Massachusetts.

In 1995, the Department amended the LEV regulation to adopt the fleet-wide emission average for non-methane organic gases (NMOG), and to clarify certain sections of the regulation. The NMOG fleet-wide emission average, which California incorporated in its regulation in prior years, gave automobile manufacturers flexibility by allowing them to decide which standards to certify vehicles to as long as the fleet-wide average is met.

In 1999, the Department further amended the regulation to adopt the next generation of California emission standards known as "LEV II", effective in MY 2004 for all passenger vehicles and most sport utility vehicles (SUVs) and LDTs. The Department also adopted the LEV I emission standards for medium-duty vehicles, including diesel vehicles and engines, effective in MY 2003 vehicles. The 1999 revision introduced the PZEV as well, which manufacturers could use to meet up to 6% of their 10% ZEV requirement.

In 2001, Massachusetts adopted California's "Not-to-Exceed" (NTE) emission standards and test procedures for heavy-duty diesel engines (HDDE) and vehicles. To date, fifteen states outside of California and the District of Columbia have also adopted these standards. The NTE standards were put in place to address a regulatory gap in MY 2005 and 2006 federal emission standards that would have allowed HDDE manufacturers to produce higher polluting trucks.

The 2002 Amendments

In December 2001, the Department adopted California's 2001 ZEV amendments as an emergency regulation. After completing the public review process, the Department adopted a final regulation, which became effective on January 1, 2003. The Department also promulgated the voluntary Northeast ACP in 310 CMR 7.40 to give vehicle manufacturers additional compliance flexibility and an opportunity to phase in the introduction of ZEVs to the Massachusetts market.

Incorporation of the California Amendments into the Massachusetts ZEV Program

In adopting California's 2001 ZEV amendments into 310 CMR 7.40, the Department reduced manufacturers' previous pure ZEV requirement from 4% to 2%, retained the PZEV requirement of 6% and allowed 2% AT PZEVs for all new MY 2006 passenger vehicles and LDT1s.

One of the key components of the ZEV Program is a credit system where manufacturers can earn credits to apply to the percentage mandates for ZEVs, AT PZEVs and PZEVs and to reward technological and commercial advancements. California's 2001 amendments expanded and revised this existing credit incentive structure. Additional credits were available to manufacturers that increased vehicle range or that use ZEVs in demonstration programs or transportation systems projects. Transportation systems projects are projects designed to reduce vehicle emissions and vehicle travel by integrating various modes of transportation (e.g., providing advanced technology vehicles for commutes from homes to train stations).

Further, the amendments increased the number of types of vehicles that could qualify for ZEV credits and altered the credit values for various aspects of vehicle technology, ZEV components, extended vehicle life and performance. The early production of City Electric Vehicles (City EVs), hydrogen fuel cell vehicles and Neighborhood Electric Vehicles (NEVs) was encouraged by initially awarding manufacturers additional credit. NEVs, for example, which have a top speed of 25 miles per hour, earned four credits for early introduction in MY 2001 and 2002, 1.25 credits in MY 2003, 0.625 for MY 2004 and MY 2005, and 0.15 for MY 2006 and subsequent model years. The credits generated by NEVs are limited to 75 percent of the requirement for any category (ZEV, AT PZEV or PZEV) in MY 2006, and to 50 percent of any category in 2007 and beyond.

Finally, effective with MY 2007 vehicles, SUVs, minivans and trucks weighing up to 8,500 pounds GVWR were incorporated into the formula for calculating the ZEV, PZEV and AT PZEV required percentages. As a result of this requirement—which raised the annual contribution of heavier light-duty vehicles—each manufacturer was obligated to sell more ZEVs if it sold more SUVs, pickups and vans. Starting with MY 2009 vehicles, and expanding by one or two percentage points each year, the

total percentage requirement of ZEVs and ZEV variations for intermediate volume manufacturers (IVMs) and large volume manufacturers (LVMs) was increased until it reached 16% in MY 2018 and beyond vehicles.

The Northeast ACP

The 2002 amendments codified the voluntary Northeast ACP, an agreement developed in conjunction with New York, Vermont (both states adopted the California ZEV program), automobile manufacturers, the Northeast States for Coordinated Air Use Management (NESCAUM) and other stakeholders. Under the Northeast ACP, manufacturers could choose to comply with either the 2% AT PZEV, 2% ZEV and 6% PZEV percentage structure, beginning with MY 2006 vehicles, or opt into the ACP for MY 2004 through 2006 vehicles. Manufacturers opting into the Northeast ACP were required to submit a compliance plan to the Department and to guarantee that vehicles sold and marketed in California would be available in Massachusetts. They were also required to meet the full California ZEV mandate by MY 2007. To date, BMW, Ford, General Motors, and Honda have opted into the ACP.

Based on the concepts of California's core credit scheme, the Northeast ACP assigned PZEVs, AT PZEVs and ZEVs sold in Massachusetts a certain number of credits in accordance with their emissions standards and baseline qualifications. Massachusetts vehicles were also subject to the northeast phase-in multiplier, which gave manufacturers extra credit for phasing in ZEVs during the ACP's first three years. Manufacturers could buy, sell or trade credits under the ACP.

The ACP phased in the percentages of ZEVs, PZEVs, and AT PZEVs for large volume manufacturers (LVMs). For example, LVMs could use PZEV credits to meet the entire 10 percent requirement for MY 2004 vehicles and 90% of the 10% requirement for MY 2005 vehicles, eventually capping at 60% in MY 2007. Until the end of MY 2006, manufacturers could also obtain as much as a 25 percent credit towards their total annual requirement for ZEVs, PZEVs and AT PZEVs by implementing special projects that address the infrastructure challenges of alternative fuel refueling, fuel cells and home recharging of electric vehicles. In addition, credits could be granted for projects that integrated advanced technology vehicles into innovative transportation systems.

III. CHARACTERIZATION OF THE OZONE PROBLEM

Formation and Sources of Ozone

Ground level ozone, or smog, is not directly emitted by automobiles or other sources of air pollution, such as power plants, but is formed when NOx reacts with volatile organic compounds (VOCs) in the presence of sunlight and heat. Ozone occurs most frequently during hot summer months.

VOCs are emitted in the form of exhaust and evaporative emissions from petroleum-fueled automobiles, trucks and boats, some industrial and fueling operations, and other sources of evaporative emissions such as lawn mowers, paints, hairsprays and cleaning liquids. NOx is produced whenever fuels are burned and is found chiefly in motor vehicle exhaust and in emissions from power plants, industrial boilers and other major combustion sources.

Health and Environmental Effects of Ozone and Ozone Precursors

Ozone is a photochemical oxidant that can cause lung dysfunction and eye, nose and throat

irritation. It can also exacerbate respiratory illness and reduce resistance to infection. Ozone is of particular concern for children, the elderly, people with asthma and other chronic respiratory diseases and people exercising and working outdoors for prolonged periods of time. It can also damage forests, other vegetation and agricultural crops as well as natural and synthetic materials.

Besides being a predominant factor in the formation of ozone, many VOCs are toxic and some are suspected carcinogens. NOx emissions contribute to the nitrification of water bodies, acid deposition, and increased particulate and ambient nitrogen dioxide (NO_2) levels. NO_2, one component of NOx, may cause sever respiratory inflammation, pulmonary distress and severely aggravates symptoms associated with asthma and bronchitis.

Massachusetts Ozone Non-Attainment Areas

Massachusetts contains two ozone non-attainment areas under the federal one-hour ozone standard of 0.12 parts per million (ppm). The western Massachusetts non-attainment area is comprised of Hampden, Hampshire, Franklin and Berkshire counties. The eastern Massachusetts non-attainment area encompasses the remainder of the state. Both of these areas are classified as "serious" non-attainment, according to EPA's classification of ozone non-attainment areas. Both areas will continue to be classified as serious non-attainment areas under the one-hour standard until the standard is revoked or until the area no longer records violations and seeks redesignation.

In 1997, in order to provide increased health protection against longer exposure periods, EPA revised the ozone public health standard from the one-hour standard to a more protective eight-hour standard of 0.08 ppm. Of the 14 ozone monitors in Massachusetts, nine violated the eight-hour standard for the 2000-2002 period.

Therefore, in July 2003, as required by the CAA, Governor Mitt Romney recommended to EPA that the entire state be classified as non-attainment for the eight-hour standard with the same two non-attainment areas—eastern and western Massachusetts. In November 2003, EPA has indicated that it agrees with this recommendation and is expected to formally designate the two areas as non-attainment of the eight-hour standard in April 2004. At that time EPA will classify all non-attainment areas (moderate, serious, etc.) under the eight–hour standard according to the severity of their ozone problem.

In addition to violating the eight-hour ozone standard within its own borders, Massachusetts contributes to violations of the eight-hour standard in southern New Hampshire and Maine. The Department believes that additional regional and local emission reductions will be necessary if Massachusetts is to attain the eight-hour ozone standard and mitigate its contribution to ozone transport into these two states. Adoption of the revised ZEV requirements will help Massachusetts attain and maintain the ozone standard by reducing emissions of air contaminants from motor vehicles.

IV. SUMMARY OF THE AMENDMENTS TO 310 CMR 7.40

The primary changes to the Department's ZEV regulation mandate, which reflect the 2003 California amendments, include:

- A new vehicle model year to which the proposed amendments first apply (MY 2007)
- An alternative compliance path where manufacturers may choose to develop, deliver and place in service a specified number of fuel cells to meet the pure ZEV requirement in the ZEV mandate

- A "travel" provision allowing manufacturers that produce fuel cell vehicles for the California ZEV program to obtain credit for those same vehicles in Massachusetts
- Numerous revisions to the credit structure, including the credits allocated for ZEVs and AT PZEVs, the timeline for awarding credits and the allocation of credits for the early introduction of vehicles and vehicles with greater range
- The elimination of all references to fuel economy and efficiency for AT PZEVs
- A new date for placed-in service credit (September 30, 2003 for MY 2001-2002 vehicles and June 30 for subsequent model years)
- A modification to the criteria used to determine whether a hybrid electric vehicle (HEV) earns credit for advanced ZEV components
- Amendments to provisions regarding leased vehicles

The amendments adopt CARB's new classification system for pure ZEVs, AT PZEVs and PZEVs. Pure ZEVs, which do not emit either criteria or toxic pollutants, merit the "gold" distinction. AT PZEVS and PZEVs, which emit minimal amounts of these pollutants, are respectively known as "silver" and "bronze" ZEVs.

A New Vehicle Model Year Effectiveness Date

The Department has changed the model year in which the ZEV percentage requirements become effective from MY 2006 to MY 2007 vehicles. This is consistent with Chapter 177 of the CAA which requires any state adopting California emission standards to adopt the standards at least two years before the model year to which they apply. However, manufacturers may earn and bank credits for any vehicles produced and placed in service prior to the 2007 model year.

The Base Compliance Path vs. the California ACP

In adopting California's ZEV revisions, the Department offers manufacturers new flexibility in how to achieve the pure ZEV requirement of the overall ZEV mandate. Effective with MY 2007 vehicles, the proposed amendments allow LVMs to either continue to comply with the ZEV (the "base compliance path") or opt into the California ACP, as incorporated in the Massachusetts regulation. LVMs that choose the base compliance path must continue to place in service 2% pure ZEVs, 2% AT PZEVs and 6% PZEVs of their total passenger cars (PCs) and LDT1s. The 2% pure ZEV requirement may be met with a variety of pure ZEVs.

Manufacturers producing and placing in service vehicles in Massachusetts may still opt into the voluntary Northeast ACP as part of 301 CMR 7.40.

LVMs that opt for the California ACP must still meet a 2% pure ZEV, 2% AT PZEV and 6% PZEV requirement; however, these manufacturers must place in service their share of a cumulative total of 250 fuel cell vehicles to meet all or part of the 2% pure ZEV obligation. Specifically, each manufacturer must generate enough fuel cell vehicles to represent 1.09 percent of its average annual sales of PCs and LDT1s, produced from MY 1997 to 2001, starting in Massachusetts with MY 2007 vehicles.

TABLE 1. THE BASE COMPLIANCE PATH VS. THE CALIFORNIA ACP, MY 2007

Compliance Path	Gold (Pure ZEVs)	Silver (AT PZEVs)	Bronze (PZEVs)
Base Compliance Path	2%	2%	6%
California ACP	250 fuel cells; and/or other new pure ZEVs and AT PZEVs or their credits	2%	6%

Manufacturers that opt to comply with the California ACP but which fail to meet the minimum fuel cell requirements must show compliance with the base compliance path for MY 2005 to 2008 in California. In Massachusetts, manufacturers would have to comply with the program beginning in MY 2007. Conversely, manufacturers that opt to comply with the base compliance path and meet the minimum fuel cell requirement may, in turn, elect to comply with the ACP retroactively for MY 2005-2008 vehicles.

Although intermediate volume manufacturers (IVMs) are required to fulfill the percentage requirements of the base compliance path—with some variations to that required of the LVMs—IVMs may not participate in the California ACP. This ACP is also not available to small volume manufacturers or independent low volume manufacturers, both of which are not required to meet the ZEV percentage mandate.

Long-Term Compliance Requirements

The ZEV mandate, for LVMs and IVMs retains the long-term ZEV requirements established in the 2001 revisions to the California ZEV mandate, starting with MY 2009 vehicles, as shown in Table 2. It pertains to PCs, LDT1s and LDT2s.

TABLE 2. LONG-TERM ZEV REQUIREMENTS, MY 2009-2016

Model Years	Minimum ZEV Requirement
2009 through 2011	11 percent
2012 through 2013	12 percent
2014 through 2015	14 percent
2016 and later years	16 percent

The California ACP also requires manufacturers to meet these increased percentages over the long-term; however, manufacturers must continue to produce and place in service a certain collective number of fuel cells for each series of model years, as shown in Table 3 on the next page. Manufacturers' fuel cell obligations therefore increase to 2,500 for MY 2009 to 2011 vehicles; 25,000 for MY 2012 to 2014 vehicles; and 50,000 for MY 2015 to 2017 vehicles. MY 2017 would be the last model year vehicle that the California ACP would be a compliance option for manufacturers. Manufacturers' long-term

percentage contribution is based on the average of three years of sales occurring four to six years in advance of the model year in which the percentage requirements take effect.

TABLE 3. LONG-TERM FUEL CELL REQUIREMENTS, MY 2009-2017

Model Year Period	Collective Number of Fuel Cell Vehicles, All Manufacturers
2009-2011	2,500
2012-2013	25,000
2015-2017	50,000

In the base compliance path and the California ACP, the maximum percentage of the ZEV requirement that a manufacturer may meet with PZEVs remains at 6% of the total ZEV percentage requirements. On the other hand, manufacturers can use AT PZEVs or the credits generated from them to fulfill up to one half of a manufacturer's remaining ZEV requirement.

Options for Meeting the Pure ZEV Requirement

The California ACP, which the Department has adopted, offers manufacturers a number of ways to fulfill the 2% pure ZEV requirement. In addition to producing new fuel cell vehicles, the amendments allow manufacturers to apply credits from vehicles produced in MY 2001-2004 to their market-share requirement of fuel cells for MY 2005 to 2008 vehicles; the proposed amendments increased the value of the credits assigned to manufacturers for MY 2001 through 2008 fuel cell vehicles, thus giving manufacturers additional incentive to produce fuel cell vehicles earlier.

Manufacturers may also meet up to one-half of their 2% requirement for pure ZEVs with MY 2004-2008 City battery electric vehicles (BEVs) and full function BEVs for the 2005 through 2008 model years. City EVs and BEVs use pure ZEV components. Subsequent model year City BEVs and full function BEVs can also be used to satisfy pure ZEV requirements in later compliance years.

Finally, under the California ACP, manufacturers may use credits from AT PZEVs to meet the pure ZEV gold requirements as long as they meet their minimum required number of fuel cells.

Options for Meeting the AT PZEV Requirement

The base compliance path and the California ACP offer similar options with the AT PZEV silver category. Manufacturers may use up to 75% of banked NEV credits to meet the silver percentage requirement in MY 2009 and up to 50 percent in 2010 and later model years. The NEV cap for the gold category in both the California ACP and the base compliance path remains the same; NEV credits may represent up to 75% of pure ZEVs starting with MY 2006 vehicles and up to 50% of MY 2007 vehicles. There is no ceiling on the percentage number of NEV credits that can be applied to PZEVs. This limitation is based on NEVs having a lower functionality (e.g. limits on access to certain roadways) and cost than pure ZEVs.

The amendments also expand upon the use of PZEV credits. The amendments propose dedicating the extra credits earned from generating over and above the required percentage of PZEVs in MY 2003 and 2004 vehicles to the AT PZEV minimum required percentages for MY 2005 and 2006 vehicles.

Options for Meeting the PZEV Requirement

According to the Department's amendments, which adopt California's ZEV mandate, manufacturers must continue to provide PZEVs to meet the PZEV percentage requirement**.** There are no options for meeting this requirement other than with PZEVs.

The "Travel" Provision

In adopting the 2003 California amendments, the Department has incorporated a "travel" provision, where manufacturers can obtain credit in the Massachusetts ZEV regulation for fuel cell vehicles produced, sold and placed in service in California. Conversely, if manufacturers produce and place in service vehicles in Massachusetts, the credits from these vehicles can be applied to manufacturers' regulatory obligations. In the amendments, MY 2011 would be the last model year to which the travel provision would apply.

Revisions to the Credit Structure

The Department's adoption of the California ZEV rule created new credits, eliminated others, and amended several aspects of the existing credit allocation structure.

Eliminated Credits

In adopting California's amendments, the Department revised the existing ZEV credit structure for calculating the amount of credits for particular types of vehicles. The 2003 amendments remove the efficiency multiplier and establish a precise number of credits for each of the five types of pure ZEVs currently in service, according to their model year, as shown in Table 4 below.

TABLE 4. CREDIT VALUES FOR TYPES OF PURE ZEVS, MY 2003-2012

Tier	Example	UDDS ZEV Range	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
NEV	NEV	No minimum	1.25	0.625	0.625	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Type 0	Utility EV	<50 miles	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1
Type I	City EV	>=50, <100 miles	8	8	8	7	7	7	2	2	2	2
Type II	BEV	>=100 miles	12	12	12	10	10	10	3	3	3	3
Type III	Fuel cell EV	>=100 miles	40	40	40	40	40	40	4	4	4	3

UDDS = urban dynamometer driving cycle

New Credits

In addition to the credits identified in the section on the base compliance path and the California ACP, new provisions include the adoption of a 1.25 multiplier for BEVs and City EVs for 2004 and

subsequent model years that are sold to or are leased for three or more years to consumers who are given the option to purchase or re-lease the vehicle for two years or more at the end of the first lease term.

Revised Credits

Some revisions to existing credits include:

- An increase in the credit value for MY 2006 to 2008 fuel cell ZEVs from 15 to 40, which would help ensure the early introduction of these vehicles.
- Making the extended service multiplier applicable to MY 1997-2003 vehicles, thereby providing vehicles with additional credit.
- Doubling the in-service warranty multiplier credit for MY 2001-2004 ZEVs or grid-connected hybrid PZEVs with 10 miles or more zero emission range. Manufacturers gain an additional credit for each full year these vehicles remain registered and covered by an original warranty, beyond the initial three-year warranty. Manufacturers with vehicles that have expired warranties can also obtain this additional credit after the first three years of service for each additional year during which they can demonstrate the vehicle was in use the full year.
- Additional AT PZEV allowances for advanced component, high-pressure gaseous-fuel or hydrogen-fuel storage systems, for zero emission range (covers grid-connected hybrid electric vehicles) and for low fuel-cycle emissions (e.g. compressed natural gas vehicles)**.**
- An expansion in the use of credits for vehicle miles traveled (VMT) and advanced ZEV components for AT PZEVs such that manufacturers can apply both credits, rather than one or the other, to the minimum percentage requirement for AT PZEVs.

In other cases, existing provisions of the current ZEV requirements are clarified. The amendments make clear, for example, that the early introduction multiplier and the zero emission range multiplier credits cannot be combined for PZEVs.

Amendment to the AT PZEV Definition

A legal challenge against the ZEV mandate in California led to a federal district judge enjoining CARB from implementing the 2001 ZEV amendments as they pertain to MY 2003 and 2004 vehicles. In response, California has removed all references to fuel economy and vehicle efficiency relating to AT PZEVs.

New Date for Placed-In Service Credit

With the adoption of California's ZEV amendments, the Department adjusted the date by which a ZEV must be placed in service in order to qualify for the ZEV early introduction multiplier credit. MY 2001-2002 ZEVs must be placed in service in Massachusetts by September 30, 2003 to earn the ZEV early introduction multiplier. Although the California revisions were adopted after this date, this provision applies retroactively. For 2003 and subsequent model years, a vehicle would be viewed as being placed in service if this occurred in California by June 30 after the applicable model year.

Reconfiguration of HEV Criteria

In adopting California's ZEV rule revision, the Department has changed the criteria for determining if a hybrid electric vehicle earns credit for advanced ZEV components. HEVmust now demonstrate rated peak power, voltage level, traction drive boost, regenerative braking and idle start/stop to qualify for one of three levels of AT PZEV credits, as shown in Table 5 below.

TABLE 5. HEV ADVANCED COMPONENTRY REQUIREMENTS AND CREDIT, MY 2005-2015

Level HEV	Voltage & Power	AT PZEV Credits	Applicable MYs
Level 1 HEV	<60 volts and ≥ 4 kW	0.2 credits	MY 2005-2011
Low voltage, low power	motor power		
Level 2 HEV	≥60 volts and ≥10 kW	0.4 credits	MY 2005-2011
High voltage	motor power	0.35 credits	MY 2012-2014
		0.25	MY 2015 +
Level 3 HEV	≥60 volts and ≥50 kW	0.5 credits	MY 2005-2011
High voltage, high power	motor power	0.45 credits	MY 2012-2014
		0.35 credits	MY 2015+

The amendments eliminate the use of "peak power ratio" as a criterion for qualifying for advanced components. They also increased the credit assigned to grid rechargeable HEVs through MY 2011 in order to encourage manufacturers to produce this type of vehicle. Certain HEVs must now have an advanced energy storage system to earn additional credit for advanced components. The sunset on this allowance occurs in MY 2012.

Amendments to Provisions Regarding Leased Vehicles

The proposed amendments adjust the extended lease provision to require manufacturers to offer at least two additional years on leased vehicles. In certain cases, re-leased BEVs may now be used in the California ACP, according to the Department's amendments, which adopt California's revisions.

Other Changes

The amendments mandate that manufacturers submit annual reports to the Department by May 1 of the calendar year following the close of the model year. These reports must identify the delivery and placement of vehicles generating ZEV credits. Manufacturers may update the reports by September 1 to cover activities between April 1 and June 30.

For other minor changes to the current regulation see Appendix E, CARB's *Second Notice of Public Availability of Modified Regulatory Text: Public Hearing to Consider Adoption of the 2003 Amendments to the California Zero Emission Vehicle Regulations*, *Last Day for Comment on Second Supplemental Notice: October 27, 2003;* Appendix F*, Resolution 03-4, April 24, 2003*; and, Appendix G, *Description and Rationale for Staff's Additional Proposed Modifications to the January 10, 2003 ZEV Regulatory Proposal, March 5, 2003*. These documents can also be found on the website http://www.arb.ca.gov/msprog/zevprog/2003rule/2003rule.htm.

V. REGULATORY DECLARATIONS

Section 177 of the Clean Air Act

The ZEV Program regulatory amendments meet the provisions of Section 177 of the CAA, which require that the Massachusetts emissions standards be put in place two years before the model year to which they will apply. The Department adopted the ZEV standards more than two model years prior to the effective date of the standards in MY 2007 by filing an emergency regulation with the Massachusetts Secretary of State on December 19, 2003. MY 2007 is the first model year that will be affected by the ZEV Program amendments.

Section 177 of the CAA also mandates that if a state adopts the California motor vehicle emission standards, the standards must be "identical to the California standards" for which California received a waiver of preemption from implementing the federal motor vehicle emission standards from EPA. The amendments to 310 CMR 7.40 directly cite and/or incorporate by reference the applicable sections within Title 13 of the CCR. They also include language from the "California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," which can be found in Attachment 2 of Appendix D.

M.G.L. c. 111, Section 142K

The regulatory amendments meet the requirements of M.G.L. c. 111, Section 142K**,** which requires the Department to adopt and implement California motor vehicle emission standards

> "unless, after a public hearing, the Department establishes, based on substantial evidence, that said emission standards and compliance program similar to the state of California's will not achieve, in the aggregate, greater motor vehicle pollution reductions than the federal standards and compliance program for any such model year."

The Department analyzed the emission benefits of LEV II and the ZEV mandate during the rulemaking process in 1999. This analysis found that the California emission standards in the aggregate would achieve greater emission reductions than the federal standards.

VI. AIR QUALITY IMPACTS

Ozone Non-Attainment

In accordance with M.G.L. c. 111, Section 142K, the Department assessed the air quality impacts of adopting the California LEV II standards, including the modifications to the ZEV mandate, as compared to the impacts of having federal standards in place in Massachusetts. This assessment was part of the Department's rulemaking process in 1999. The Department engaged the services of Cambridge Systematics, Inc. through a contract with Northeast States for Coordinated Air Use Management (NESCAUM) to perform a technical analysis prior to the adoption of the standards. The results of this analysis showed that the adoption of the LEV II standards, including the ZEV mandate, in the aggregate would result in the lowest level of on-road motor vehicle emissions in Massachusetts for NMHC, NOx, CO, and air toxics. The technical analysis is available through the Department.

Air Toxics

In the past, air pollution control programs have focused on the six criteria pollutants of the CAA: ozone, carbon monoxide, particulate matter, nitrogen dioxide, sulfur dioxide, and lead. Recently, concern has been raised over the components of air pollution that are not specifically regulated by programs developed to control criteria pollutants. These compounds are collectively known as air toxics. The health effects of air toxics are wide-ranging and can vary from short-term adverse health effects to long-term carcinogenic effects.

The CAA requires EPA to promulgate control strategies for sources of toxic air emissions. The Department intends to implement those standards as the EPA promulgates them. Until that time, the Department will control air toxics through programs aimed at controlling the traditional criteria pollutants. This regulation is expected to reduce air toxics by controlling exhaust and evaporative hydrocarbon emissions from automobiles. Hydrocarbon emissions from automobiles contain a host of toxic species, including benzene, 1-3 butadiene and formaldehyde.

Toxics Use Reduction

Implementation of toxics use reduction is a priority of the Department. Toxics use reduction is defined as in-plant practices that reduce or eliminate the total mass of contaminants discharged to the environment. The LEV program and the ZEV mandate assist in this effort by requiring vehicles sold and registered in Massachusetts to be equipped with advance emission control technology designed to reduce pollutants emitted to the environment.

VII. ECONOMIC IMPACTS

Impact on Vehicle Cost [5]

Since the proposed amendments to the Massachusetts ZEV program allow for a number of different vehicles to be produced, the impact on vehicle cost is dependent upon the type of vehicle that the manufacturer produces.

According to CARB's Resolution 03-4, the incremental cost for PZEVs is approximately $100 per vehicle, which is substantially lower than previous estimates. In addition, the PZEV extended warranty (15 years or 150,000 miles) has additional value to the customer above and beyond the normal emission warranty, which may offset any impact of the incremental cost of PZEVs.

The incremental cost of AT PZEVs is estimated to be approximately $2,300 for MY 2005 vehicles, decreasing to $500 in MY 2006 to 2008 vehicles and $200 in MY 2009 to 2011 vehicles as more vehicles are produced. In addition, AT PZEVs (hybrid vehicles) are more fuel efficient, resulting in fuel cost savings over the vehicle's life. CARB's January 25, 2003 Initial Statement of Reasons

[5]The information in this section and on cost-effectiveness is based on CARB's *Resolution 03-4, April 24, 2003; Description and Rationale for Staff's Additional Proposed Modifications to the January 10, 2003 ZEV Regulatory Proposal, March 5, 2003; and, Staff Report: Initial Statement of Reasons. 2003 Proposed Amendments to the California Zero Emission Vehicle Program Regulations, January 10, 2003*. These documents are listed in Appendices F, G and H, respectively.

estimated that hybrids with an assumed average 30% fuel economy could result in lifetime fuel savings of about $1,000 according to staff methodology. Since gasoline costs per gallon are generally lower in Massachusetts, this decreases the fuel cost savings.

In regards to pure ZEVs, an October 2001 report entitled, *ARB Staff Review of Report Entitled "Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study"*, CARB estimated the incremental costs of NEVs to be $1,000, $8,000 for City EVs, and $17,000 for full-function ZEVs. The incremental cost for full-function ZEVs is expected to decrease as technology advances and ZEVs achieve a higher market penetration

As is typical with the development of any new technology, the start-up production and pilot costs of fuel cell vehicles are significantly higher; however, as the technology is refined and becomes more widely available, costs are expected to decline dramatically in future years. Thus, the estimated per vehicle cost of a fuel cell ZEV is $1 million in MY 2005, $300,000 in MY 2006 through 2008 vehicles, $120,000 in the MY 2009-2011 period, and $10,000 in MY 2012 vehicles.

Under the California ACP, ZEVs are not required until MY 2005. The Department expects that in MY 2004 and 2005, manufacturers may decide to meet the requirements of the ACP with PZEVs and AT PZEVs. Therefore, the average incremental costs of vehicles delivered for sale in Massachusetts should be substantially lower than under the full California mandate in the early years of the program. In addition, this should also result in lower costs to the automobile manufacturers to comply with the program in Massachusetts.

Cost-Effectiveness

CARB has estimated that the cost per pound of reduced pollution reduced, or cost-effectiveness, is approximately $22.20/pound ($44,000 per ton) for PZEVs and $287.50 ($575,000 per ton) for AT PZEVs in MY 2005. The cost-effectiveness of AT PZEVs increases to $62.50 per pound ($125,000 per ton) for MY 2006-2008 vehicles and $25 per pound ($50,000 per ton) for MY 2009 through 2011 vehicles. Both PZEVs and AT PZEVs achieve emission reductions in the near-term.

Impact on Vehicle Dealerships

The adoption of the ZEV mandate, including the California ACP, is not expected to have significant economic impacts on vehicle dealerships. However, there may be some increased cost to dealers to train employees and service a wider range of vehicle technologies. Dealerships that do incur additional costs from training employees would be expected to recoup those costs through increased sales. Dealerships may experience increased sales due to the higher number of PZEVs and AT PZEVs being offered for sale.

VIII. OTHER PROGRAM IMPACTS

Massachusetts Municipalities & Proposition 2½

Municipalities will not be affected by the changes to 310 CMR 7.40 and the regulations do not require municipalities to purchase zero emission vehicles or vehicles that will generate ZEV credits. However, municipalities that purchase ZEVs and/or AT PZEVs may realize fuel costs savings over the vehicles' useful life.

Massachusetts Environmental Policy Act

The amended LEV regulation is "categorically exempt" from the Massachusetts Environmental Policy Act (MEPA) regulations, 301 CMR 11.00, because the regulation will result in reduced emission levels. All reasonable measures have been taken to minimize adverse impacts.

Agricultural Impacts

M.G.L., c. 30A, Section 18, requires state agencies to evaluate the impact of programs on agriculture within the Commonwealth. The Department has determined that the regulation will not adversely impact agriculture in Massachusetts. The only impact on agriculture will be beneficial, as the program will help reduce emissions of ozone precursors, thus lowering crop damage attributable to high ozone concentrations in the summer. The LEV standards and the ZEV mandate do not apply to farm machinery.

IX. PUBLIC PARTICIPATION

After an emergency regulation is filed with the Massachusetts Secretary of State, M.G.L. c. 30A requires that the public process (i.e., the opportunity to review background and technical information at least 21 days prior to proposing the regulation amendments at a public hearing) be completed and the permanent regulation be filed within three months.

The Department will give formal notice to comply with M.G.L. c. 111, Section 142K and M.G.L c. 30A, and for processing a rule as an amendment to the SIP. This notice will be issued 30 days before the public hearings. The public hearing will be held in Boston on February 25, 2004.